Welfare Implications of Alternative Pension Policies

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Introduction

Motivation

- U.S. public pensions are underfunded (average 66%) Details
- Pension reforms underway in multiple states Reforms
  - Benefit reductions
  - Shift to DC
  - Always controversial
- Policy choices should account for all groups
  1. pension recipients
  2. non-recipient taxpayers

Question: What is the welfare impact of public pension reforms on groups (1) and (2), and across different age cohorts?

- Today: A hybrid DB/DC plan with wage compensation

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Model Framework

- Lifecycle model with portfolio choice and fixed retirement age
- Three main agents:
  - Public pension worker
  - Private DC worker
  - (State) Government

Results: Apply to Minnesota. For hybrid DB/DC reform,

- Young public workers require ∼5% wage compensation
  - Older cohorts range from 10-25%
- If public workers receive full compensation, private sector workers suffer welfare loss (via higher tax)

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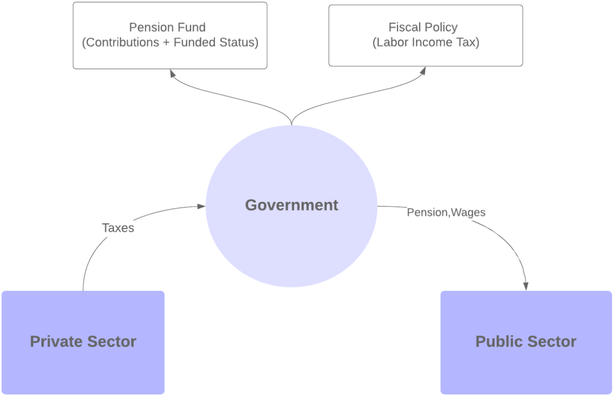
Model



Pension Fund
(Contributions + Funded Status)
Fiscal Policy
(Labor Income Tax)
Government
Taxes
Pension,Wages
Private Sector
Public Sector

Model

Public Worker

- Agents born at age 20, work, then retire at 65
- Face three sources of risk
  1. mortality
  2. market
  3. labor income
- Exogenous stochastic labor income process Y_t^{pub}

  $$log(Y_t^{pub}) = f(t, Z_t) + \nu_t + \eta_t$$

  where $f(t, Z_t)$ is common component, $\nu_t \sim N(0, \sigma^\nu)$ and $\eta_t \sim AR(1)$.
- In retirement, receive pension benefit b + social security ss^{pub}

Model

Public Worker

An age t public worker solves the Bellman

$$
\begin{aligned}
V^{pub}(t, X_t, \eta_t) = & \max_{C_t, \alpha_t} \quad u(C_t) + \beta p_t E_t[V^{pub}(t+1, X_{t+1}, \eta_{t+1})] \\
& s.t. \quad X_{t+1} = Y^{pub}_{t+1} + (X_t - C_t) R^P_{t+1} \\
& s.t. \quad R^P_{t+1} = \alpha_t R_{t+1} + (1 - \alpha_t) R^f \\
& s.t. \quad \text{Labor income process}
\end{aligned}
$$

where $R_{t+1} \sim N(\mu, \sigma^r)$ and p_t is date-t conditional survival probability

Model

Private Worker

- Private workers receive
  1. different wage process $Y_t^{priv} = \lambda Y_t^{pub}$
  2. DC plan + social security ss^{priv} in retirement
  3. labor income tax τ
- The tax τ is used to fund (i) public sector wages and (ii) shortfalls in pension fund
  - Tax depends on pension funded status χ

Model

Private Worker

An age t private worker solves the Bellman

$$\begin{aligned} V^{priv}(t, X_t, \eta_t, \chi) = & \max_{C_t, \alpha_t} \quad u(C_t) + \beta p_t E_t[V^{priv}(t+1, X_{t+1}, \eta_{t+1}, \chi')] \\ & s.t. \quad X_{t+1} = Y_{t+1}(1 - \tau(\chi')) + (X_t - C_t) R^p_{t+1} \\ & s.t. \quad R^p_{t+1} = \alpha_t R_{t+1} + (1 - \alpha_t) R^f \\ & s.t. \quad \text{Income Process} \\ & s.t. \quad \chi' \sim F(\chi) \end{aligned}$$

where $F(\chi)$ is conditional distribution of pension funded status and $\tau(\chi')$ maps funded status $\rightarrow$ tax.

Model

Government Policy

- Gov.'t observes population M with cohort distribution $\{\phi_t\}_{t=20}^{100}$
  - Proportion of public workers $q \in [0,1]$
- The government has three tasks:
  1. portfolio share α^* for pension assets
  2. maintain pension funding constraint
  3. Set tax τ to fund public wages + pension shortfalls
- The government sets tax τ to fund wages and pension shortfalls; thus,

$$\tau = \underbrace{\tau^y}_{\text{constant labor income}} + \underbrace{\tau^p}_{\text{stochastic pension insurance}}$$

Model

Pension Funding Constraint

- Pension fund enters year with
  - Assets, A
  - Immediate liabilities, B
  - Present value of future liabilities, L

  and sets government contributions G

Derivations

- Next-period value of assets $A' = (1 + r^{*\prime})(A - B + G)$
- Funding constraint: choose G such that

Full Rule

$$\frac{E[A']}{L} \in [\underline{\chi}, \bar{\chi}]$$

- G can be positive, negative

Calibration/Application

- Model developed to help guide state pension policy
- Given the set of model parameters,
  - a subset taken as universal — Universal Parameters
    - Cocco, Gomes and Maenhout [2005]
  - a subset calibrated to state environment — State Parameters
- Application: Minnesota

Data Details | Income Process | Cohort Distribution | Minnesota Portfolio | Tax Policy | MN Funded Status

Baseline Results

Workers:

- Private workers accumulate 5× more pre-retirement wealth Wealth
  - 3× higher savings rates Savings
- Private workers decrease portfolio risk with age[1] Lifecycle Portfolio

Government:

- Average pension insurance tax is negative Tax Dynamics
  - But volatile
- Pension funded status stays within bounds Pension Dynamics

[1] In practice, assume defined contribution plans offer optimal portfolio and savings rule as default options.

Policy Experiment

- Perform following hybrid DB/DC reform:
  1. Suspend pension benefits according to age-based accrual rule
     - new benefit $\tilde{b}(t) = \frac{t-20}{45} b$ Example
  2. Employees enroll in DC plan
  3. Increase wages
  4. How much do wages need to increase to keep welfare constant?

Welfare-Constant Wage Increases Vary By Age

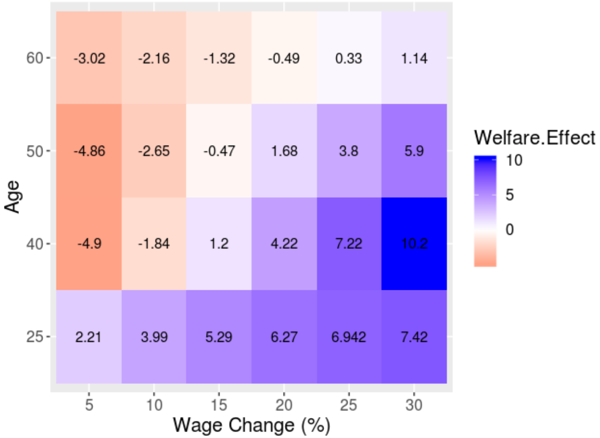


Table 2: Public Worker Welfare Effect (CE%)

How Does Transition Affect Taxpayers?

- Annual benefits/total liabilities decline over time Frozen Liabilities
- Result: Providing welfare-neutral compensation of public workers costs taxpayers Private Welfare
  - Leads to welfare loss
  - Why?
- However, young private workers prefer a *no pension plan* scenario
- Idea: it's the transition that hurts
- A caveat: (i) U.S. public funds are not running surpluses and (ii) tax rebates not realized
  - Gov.'t funding & tax policy not realistic

Conclusion

- U.S. public pension plans are in need of reform
- An applied model to make normative statements for various pension reforms
- For hybrid DB/DC reform,
  - Young public workers require $\sim$5% wage compensation
  - Older public cohorts range from 10-25%
  - All private workers hurt by transition
- Next Steps
  - More realistic state budget/tax policy
  - Differential wage process (not just scaling)
  - Demographic effect on taxpayers
  - Evaluation of existing reforms

Public Pensions–A Drag on State Finances

- In 2016, the average funded ratio for public funds was 66% (Pew Foundation Research)
- The principal factors leading to shortfalls are:
  - Insufficient contributions
  - Below expectation investment returns
  - Non-market discount rates
- One outcome: shifting burden to future generations
- Most public (private) employees are DB (DC)

Return

U.S. Public Pension Reforms

Utah (2010)

- Bound Cost of Living Adjustments (COLAs) at 2.5%
- New employees enroll in pure DC plan or hybrid DB/DC plan
- Increase employer contributions

Rhode Island (2011)

- Suspend COLAs
- Current workers enroll in hybrid DB/DC plan
- Discount rate from 8.25% $\rightarrow$ 7.5%

Oklahoma (2014)

- Create standalone DC plan for new employees
- Bound discount rate at 7.5%
- Increased employer contributions for undfunded liability

Pennsylvania (2014)

- Created hybrid DB/DC plan and DC plan for new employees
- Current employees still DB
- Benefit reduction for new employees

U.S. Public Pension Reforms

Colorado (2018)

- Hybrid DB/DC and pure DC plan (since 2006)
- Discount rate lowered 7.5% $\rightarrow$ 7.25%
- COLAs frozen at 1.5%
- Employer and Employee contributions increase

Minnesota (2018)

- Discount rate lowered 8% $\rightarrow$ 7.5%
- COLAs reduced to 1.5%
- Employer/employee contribution rates increase
- Benefit decrease for employees
  - Early retirement subsidies removed

Return

Pension Aggregates

- Given an individual pension benefit b in retirement, the aggregate period benefit is

$$B = qMb \sum_{t=65}^{100} \phi_t$$

- In a stationary environment (without cohort age change), the present value of liabilities is

$$L = \frac{1 + r^f}{r^f} B$$

discounted with the risk-free rate

Return

Pension Funding Rule

- Define χ° as the expected, next-period value of pension funded status (w/o government contributions G):

$$\chi^\circ = \frac{E[(1+r^*)(A-B)]}{L}$$

- Government contributions are determined via

$$G(\chi^\circ) = \begin{cases} \frac{L}{E[1+r^{*\prime}]}[\underline{\chi} - \chi^\circ] & \text{if} \quad \chi^\circ \in (-\infty, \underline{\chi}) \\ 0 & \text{if} \quad \chi^\circ \in [\underline{\chi}, \bar{\chi}] \\ \frac{L}{E[1+r^{*\prime}]}[\bar{\chi} - \chi^\circ] & \text{if} \quad \chi^\circ \in (\bar{\chi}, \infty) \end{cases}$$

- Given the required contribution, the government chooses τ^p such that

$$G = \tau^p M \sum_{t=20}^{65} \phi_t (1 - q_t) E[Y_t]$$

Return

Universal Calibrated Parameters

Parameter	Value	Description
β	.96	discount factor
γ	10	risk aversion
T	65	retirement age
r_f	.02	risk-free rate
μ^r	.06	risky mean return
σ^r	.157	risky vol
σ^ν	.074	transitory shock
σ^η, ρ	.011,1	persistent shock
p_t	–	survival prob

Table: Universal Model Parameters

Return

State Calibrated Parameters

Parameter	Value	Description
b	21.2k	Pension
M	2.86 mil	Total population
ϕ_t	–	Age cohort dist.
q	0.18	Prop. public workers
λ	1.154	Wage differential
$\underline{\chi}, \bar{\chi}$	.7,1.2	Pension bounds
α^*	.8	Plan risky asset share
ss^{pub}, ss^{priv}	20.8,22.08	Social security benefit

Table: Minnesota Model Parameters

Return

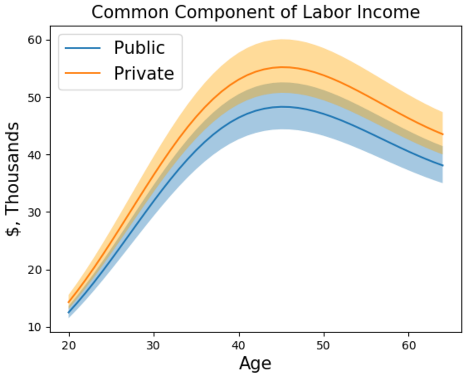
Data Details

- Labor income: PSID, Cocco, Gomes and Maenhout [2005]
- Universal parameters: Cocco, Gomes and Maenhout [2005]
- Investment policy: 2016 Minnesota State Board of Investment
- Age demographics, population: census, MN Annual Workforce Report
- Wage differential: Keefe [2011], Employer Costs for Employee Compensation Survey (BLS)
- Mortality rates: National Center for Health Statistics

Return

Labor Income Process

- Source: PSID, Cocco, Gomes and Maenhout [2005]
- Unit: individual, male with college education



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Minnesota Age Demographics

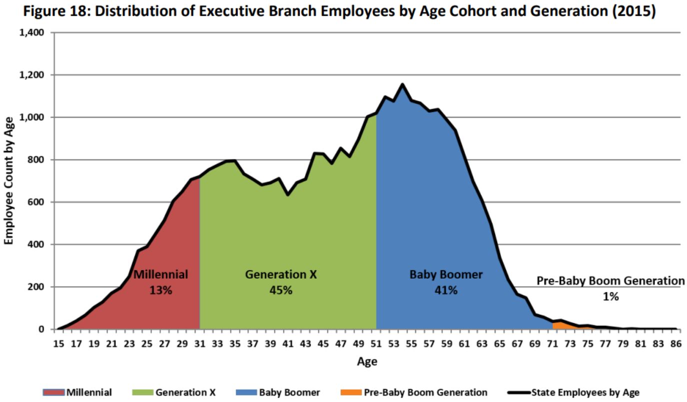


Figure: 2015 Minnesota Workforce Report

Return

Minnesota Pension Portfolio

Asset	Portfolio Weight
US Equity	.45
Non-US Equity	.15
Alternative	.20
Bonds	.18
Cash	.02

Table: 2016 Minnesota State Board Annual Report

Return

Tax Policy

- Calibrated labor income Y_t is after-tax such that $Y_t = (1 - \tau^y)\tilde{Y}_t$
- Initial labor tax τ^y set via

$$\tau^y = \frac{q}{1-q} \frac{\sum_t \phi_t E[Y_t^{pub}]}{\sum_t \phi_t E[Y_t^{priv}]}$$

- Given increase of $\lambda > 0$ to public wages, new after-tax income written

$$Y_t^{priv*} = Y_t^{priv}\left(1 - \frac{\lambda \tau^y}{1 - \tau^y}\right)$$

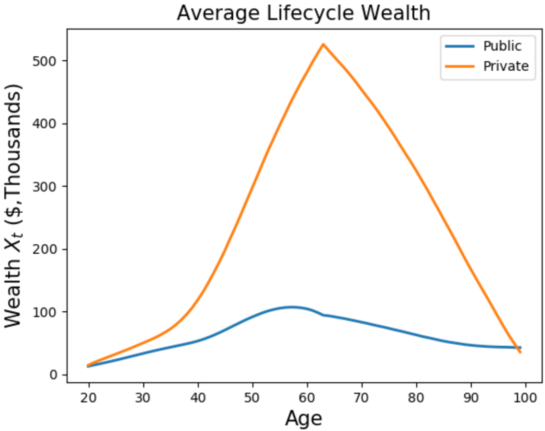
Return

Minnesota Funded Status

- Using four primary state funds/assets ($, bil):
  1. Teachers (21)
  2. GERF (20)
  3. State Employees (12)
  4. St. Paul Teachers (1)
- Respective funded status':$(.768, .778, .852, .645)$
- Leads to representative funded status of 0.79

Return

Wealth Accumulation



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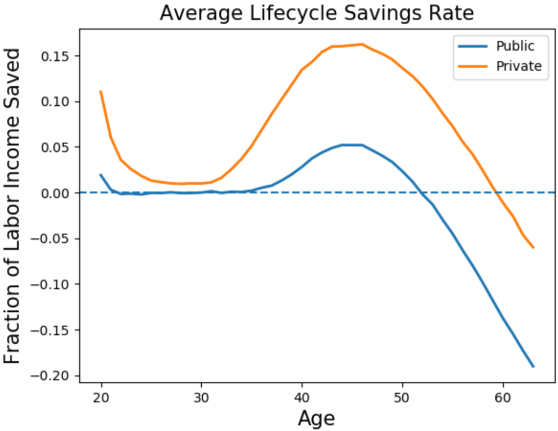
Savings Rates



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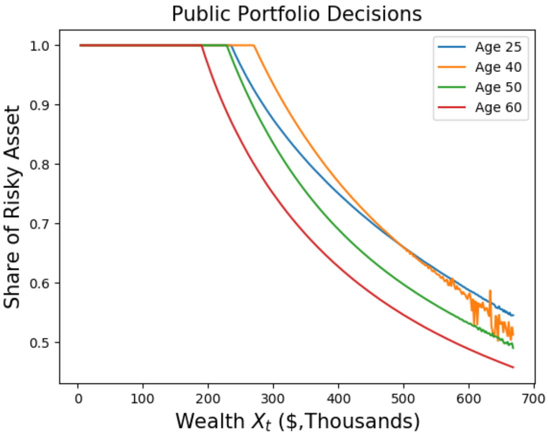
Lifecycle Portfolio Choice



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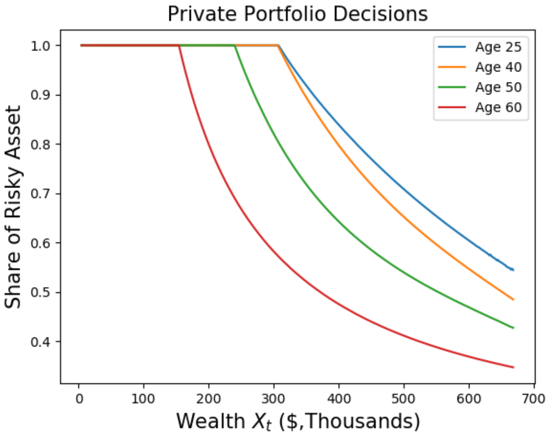

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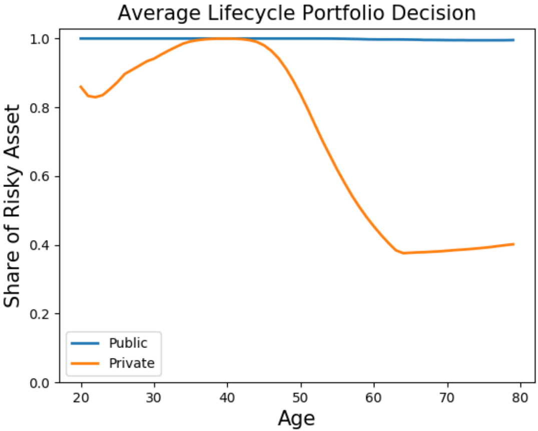

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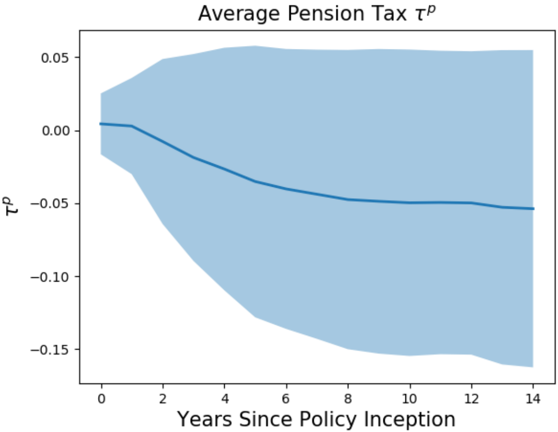
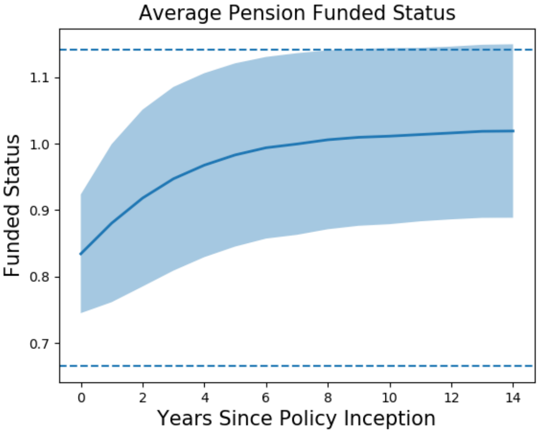
Tax Dynamics



Return

Pension Dynamics



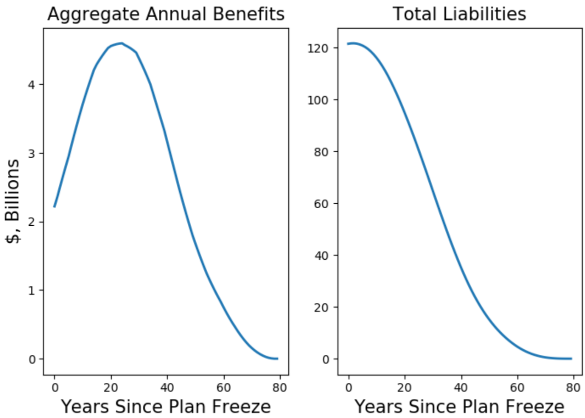
Return

Accrual Rule

Age	New Benefit ($,Thousands)	Old Benefit ($,Thousands)
25	2.4	21.2
40	9.4	21.2
50	14.1	21.2
60	18.8	21.2

Return

Evolution of Frozen Pension Liabilities



Return

Public Worker Welfare

Frozen Plan with Wage Compensation

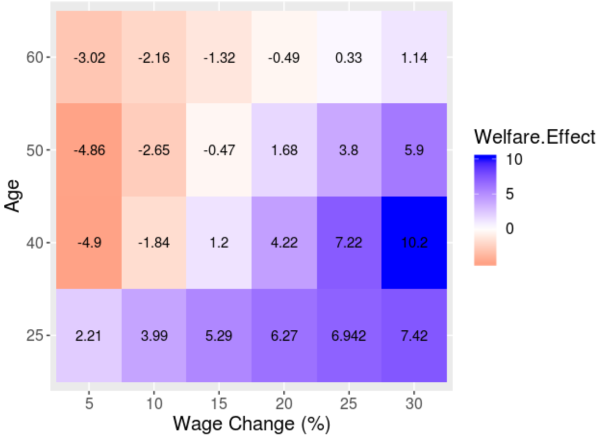


Table 2: Public Worker Welfare Effect (CE%)

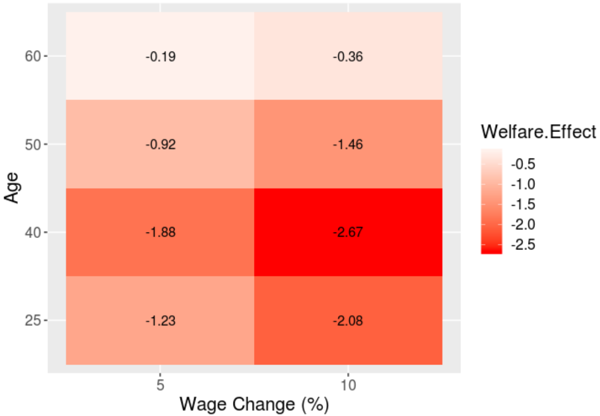
Private Worker Welfare

Frozen Plan with Wage Compensation (75% Funded Status)

Return

Private Worker Welfare

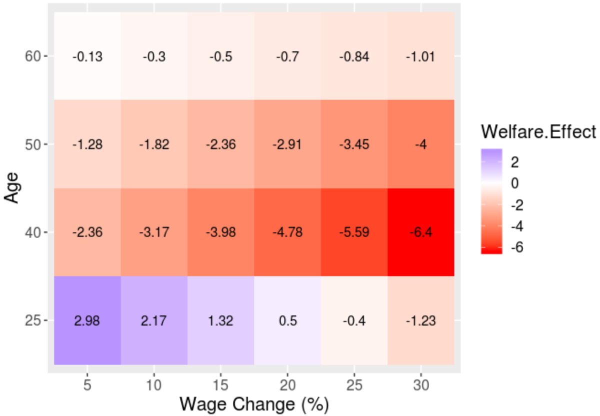
Frozen Plan with Wage Compensation (100% Funded Status)



Private Worker Welfare Effect (CE%)

Private Worker Welfare

No Pension Plan with Wage Compensation (75% Funded Status)



Private Worker Welfare Effect (CE%)

Private Worker Welfare

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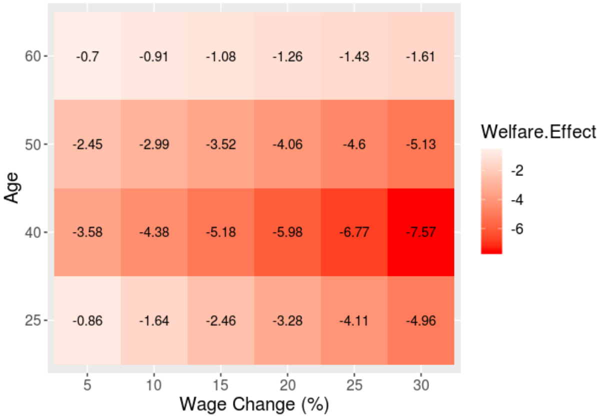

Private Worker Welfare Effect (CE%)